

# Certificate

## Standard Reference Material 1511

### for

## Determination of Dielectric Constant\*

### Cyclohexane

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This material is intended for use in the calibration of cells for determination of dielectric constants. It was obtained from Distillation Products Industries of Rochester, New York and it met the American Chemical Society specifications for cyclohexane suitable for use in ultraviolet spectroscopy. It is not purported to be a standard of purity and is not free of traces of water.

The dielectric constant\*,  $\epsilon$ , obtained on representative bottled samples was:

20 °C	$2.02280 \pm 0.00004$
25 °C	$2.01517 \pm .00004$
30 °C	$2.00733 \pm .00004$

\*(This quantity is also called relative permittivity. The values given are relative to vacuum-not air).

The uncertainties listed represent the maximum deviation of observed values from the mean. The standard deviation of the mean of eleven measurements at 30 °C was 0.000028 units. Using the derivative  $d\epsilon/dt = -0.00154/^\circ\text{C}$ , relative values of  $\epsilon$  in the range 10° to 40 °C may be calculated without significant error.

Based upon a summation of the probable uncertainties due to known sources of error in the measurements, the values of  $\epsilon$  listed above are estimated to be accurate to  $\pm 0.02$  percent or better.

**METHOD OF MEASUREMENT** Measurements of the dielectric constant were made in the frequency range 0.75 to 12 kHz using a Type 1615-A capacitance bridge, manufactured by General Radio Co., along with two three-terminal cells designed for "absolute" measurements of the dielectric properties of liquids. An oil bath controlled to within 0.01 °C was used to thermostat the cells. A suitable resistance thermometer and "Mueller" bridge were used to determine the temperature of the bath.

**DISSOLVED MOISTURE** Gain or loss of dissolved water will shift the dielectric constant of this material. Test measurements at 30 °C showed an increase of 6 to 8 parts in 20000 between samples dried over "Drierite" and those saturated with water at 20 °C. In use therefore a possible uncertainty in  $\epsilon$  of about 0.04 percent exists due to this factor. However in normal use (with limited exposure to air up to 65 percent relative humidity), the moisture change in this sample can be expected to lead to an uncertainty of less than 0.01 percent.

The work leading to the certification of this Standard Reference Material was performed in the Polymers Division, Institute for Materials Research, National Bureau of Standards.

Washington, D. C. 20234  
April 24, 1969

W. Wayne Meinke, Chief  
Office of Standard Reference Materials